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COMMONWEALTH PHYTOPATHOLOGICAL NEWS

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SPRAY TECHNIQUES: HAND-OPERATED SPRAYERS

FROM THE MANUFACTURER'S POINT OF VIEW

by A. C. Tunstall, formerly Mycologist to the Indian Tea Association, Assam

The making of sprayers for use on farm land and in large orchards has no distinctive features to separate it from general agricultural engineering. The demand for new machines of this type is small compared with that for hand operated ones used by gardeners at home and small scale farmers overseas. The gardener in Britain is usually satisfied with a garden syringe, ordinary or self-supplying, and a small, quart size, compression sprayer. He is not usually interested in any of the larger machines. On farms, however, a lime-washing sprayer is used occasionally. As this kind of machine lasts a lifetime there is not much demand for it annually. In Ireland and other areas where smallholders grow large plots of potatoes, knapsack sprayers of the kind invented by Vermorel over 60 years ago are frequently used. For the overseas market the compression type of two or three gallons working capacity is preferred not only for agri-horticultural purposes but also for the control of disease-carrying insects. The "Expert Committee on Insecticides" of the World Health Organisation has issued a specification for compression sprayers (WHO/EQP/I. RI.) that is a most valuable contribution to the improvement of the design of this type of apparatus — it sets a definite standard. It is, however, doubtful whether any of the makers of similar machines in Britain have so far conformed to it. It is indeed probable that few of the manufacturers have taken the trouble to obtain a copy. It is at first sight difficult to understand such apathy.

The production of hand-driven sprayers in Britain is almost exclusively controlled by the Brass Trade. One of the characteristics of the development of British manufacture has been and, in the brass trade, still is the small workshop in which much of the work is done by the proprieter himself. In some old dilapidated house, approached by a dark dirty stair there is a number of single room workshops devoted to a variety of trades. In the brass shop a grey-haired man may be seen

bending over a lathe while his mate is soldering at a bench nearby. The contents of the room are thickly coated in dust and a pile of brass turnings litter the floor round the lathe. A couple of old tea chests hold scraps of metal. There is usually a sink in the corner and beneath it a tin half full of used tea leaves. A few old cupboards with dingy doors that don't close, an old-fashioned coke stove, a few nails as coat hooks, and possibly a stool or chair completes the furnishing. Receipts and orders are speared on wires that hang in one of the corners. It is not an inspiring sight but it is in such shops that some of the best work is done. These owner-craftsmen would scorn to save a few pence by using inferior materials or by skimping the workmanship. For generations they have made garden syringes that never wear out and their manufacture still affords a comfortable living to their makers.

Similar products are now being made by larger firms using labour-saving devices but on account of their much larger overheads it often pays them to buy from the owner-craftsman. It is, however, difficult to get interchangeable components made satisfactorily by the owner-craftsmen. The brass worker uses a tool for turning the screw threads. This tool is usually made by the user himself and there is very considerable variation. To correct this, one firm issued gauges to their outworkers. One of the latter complained that the gauges were no good because they did not fit any of his threads. This was not so silly as it seems as the gauges were made to fit sharp edged threads while the brass working tools produced rounded ones. Incidentally the rounded edges are preferable where the threads are likely to be in contact with corrosive fluids.

The making of brass containers for both knapsacks and compression sprayers is still largely carried out by the owner-craftsmen. The work is done better and more cheaply than in the larger factories, but it is impossible to expand production quickly. This does not matter much in the case of the home trade as most of sales occur in 3 or 4 months each year leaving 8 or 9 months in which stocks can be built up — also, demands can be anticipated. In the overseas markets it is not so easy and in most cases large numbers are asked for at short notice. Also design requirements differ considerably in the very diverse conditions overseas. The firms specializing in spraying machinery cannot afford to instal expensive machinery for large scale production unless there is a clear indication of future large orders. When this background is understood it is not so surprising that progress has been so slow. The industry is only just emerging from the "one-off" stage. It would seem obvious that the basic components of the sprayers for overseas markets should be so designed that they could be produced in large numbers by engineering firms that specialise in the making of similar items for other purposes. It would then be possible to expand production readily when necessary and also to contract it to normal proportions without causing hardship to the work people. This, however, involves careful planning beyond the scope of most spraying machine manufacturers in Britain.

The efficiency of spraying apparatus is largely dependent on the suitability of the discharge equipment used with it. It is difficult for the manufacturer to know what is actually required. Very few have anyone on their staff with first hand knowledge of spraying technique. To maker matters worse the potential users are often unable to state clearly what they require because they do not know what is available. It is well to consult the makers direct explaining the problem and giving a suggested layout, asking them for their suggestions. This may avoid a cumbersome arrangement that may result from choosing unrelated components from a catalogue.

The great progress made in the formulation of crop protection substances demands discharge equipment capable of very low volume spraying. As most of the potential users cannot afford to buy, or to maintain efficiently, engine-driven apparatus it it seems obvious that simple and cheap hand operated machines are urgently needed. It is not clear how many of the manufacturers of hand-operated sprayers have development personnel capable of translating the results of the recent researches in droplet formation and distribution into practical production designs. For reasons suggested earlier it seems unlikely that any of the existing firms will undertake such development — at any rate so long as the home market continues to buy their products. It would appear that further development of hand-operated, very low volume sprayers will be left to organisations operating on more comprehensive lines.

Transport of goods to a remote location is another difficulty. In not a few places there are times when goods transport is impossible. As the treatment of pests and

blights must be done at the right time it is very important to inform the suppliers of any critical dates of this kind. When only a few machines are wanted it will sometimes pay to have them taken apart and packed in packages suitable for transmission by post. As neither manufacturers nor their agents have second sight it is well to give them very clear and definite instructions.

When dealing in overseas markets manufacturers require to appoint agents. Roughly half the price shown in the catalogue goes in remunerating agents, wholesalers, and retailers. As these usually have areas allotted to them they generally get their rake-off whether or not they render any assistance to the customer. The passing on of goods may involve many hands especially when their final destination is a long way from the port. Customers can in such cases help themselves by writing direct to the manufacturer, enclosing a copy of any order given to a local shopkeeper or agent.

It should be emphasized that the spraying apparatus made in Britain is of very high quality and not unduly high priced. It is, however, difficult to make any changes in traditional patterns. Discharge equipment, being made up from small parts, can be arranged to suit the users needs if such can be made clear to the manufacturers. It is suggested that persons specially interested in crop protection work should seek an opportunity to visit one or more of the manufacturers, preferably at their works, and explain their problems.

BRITISH MYCOLOGICAL SOCIETY

Plant Pathology Field Meeting, 1957

A group inspecting exhibits at the conversazione given by the Botanical Society of Edinburgh

The 1957 summer meeting was held in Edinburgh on 4th and 5th July when about 50 members and visitors attended, some from overseas. Those countries represented included Canada, India, Iran, Jamaica, Mauritius, New Zealand, and Pakistan.

On the morning of 4th July the Scottish Society for Research in Plant Breeding was visited at Pentlandfield, Roslin. Special attention was given to the work in breeding for resistance to blight and various viruses in potatoes, and to stem eelworm in oats.

In the afternoon the party visited the laboratories and fields of the Department of Agriculture for Scotland's Scientific Services at East Craigs, where current work was demonstrated. In the course of discussion on cereal diseases in the

field a member of the visiting party identified symptoms in oats as almost certainly those of cereal yellow dwarf virus, hitherto unrecorded in Scotland.

At an evening conversazione given by the Botanical Society of Edinburgh, interesting exhibits were contributed by the Royal Botanic Garden, several University and Government Departments, the Scottish Horticultural Research Institute at Mylnefield, Dundee, and the Forestry Commission.

The second day was taken up with a tour of the Clydeside fruit growing area where problems such as virus diseases in raspberries, plum canker, red core of strawberries, and tomato diseases were seen.

A meeting of the Scottish Advisory Plant Pathologists on the 3rd July in Edinburgh and East Lothian was arranged by the Edinburgh and East of Scotland College of Agriculture and was attended by a number of the plant pathologists from England who also participated in the B.M.S. meeting. Laboratory and field work in progress on potatoes, peas, and other crops were described and demonstrated by Dr. Boyd and his staff. All who attended, especially those who were able to be present on all three days found the meeting extremely interesting and instructive.

M. Noble

FROM NEAR AND FAR

Mr. J.A. Spence, plant pathologist of the Department of Agriculture, Trinidad and Tobago, reports in a personal communication that the presence of sugar-cane leaf scald, Xanthomonas albilineans, in St. Lucia, British West Indies, has now been confirmed. (In this connection an apology is due for having referred Martinique, where the occurrence of the same disease was reported in the last issue of C.P. NEWS, to the B.W.I. instead of the French West Indies.) The disease appears to have been present in St. Lucia for some time, and it is possible that a search through all the smaller West Indian islands, where plant introductions in the past have been subject to few precautions, would show this pathogen to be more widespread than present records indicate.

Books of Interest

BRITISH TREES by M. Hadfield (Dent & Sons, Lond., xxv + 468 pp. 30s.) describes the common indigenous and exotic trees in the British Isles for the layman, with drawings. Trees such as the 'monkey puzzle', deodar, tulip, etc. are included, and there are notes on the more important pests and diseases.

To celebrate the centenary of the Science Museum, London, H.M. Stationery Office have published THE SCIENCE MUSEUM: THE FIRST HUNDRED YEARS, iv + 85 pp., Lond. 1957. 15s.

The annual report of the Zoological Society of London is of particular interest to others than zoologists in containing details of plans for the rebuilding of the 'zoo' in conjunction with reconstruction of Regent's Park Gardens.

Botanists who might miss the announcement of its publication elsewhere will be interested to know of OXFORD BOTANIC GARDEN, a guide to the garden, the oldest in Britain, by C.D. Darlington, and G.W. Robinson. (Basil Blackwood, Oxford. 48 pp. 2/6d.) The section listing the tree collection notes the natural or artificial origin of these and the date of introduction.

The United States Natural Science Foundation undertakes to make all publications available to scientists who need them. Enquiries should be addressed to the Publications Office, Natural Science Foundation, Washington, 25, D.C.

The sugar beet crop of Britain may be a million tons short this year owing to an unprecedented epiphytotic of beet yellows virus, especially in the east and south-eastern counties. The mild winter and dry spring resulted in an abnormal population of the aphid vector, but despite warnings only a quarter of the beet acreage was sprayed, and only some sixth of this effectively. Losses are estimated at £6m. and 150,000 tons of sugar.

PLANT DISEASES IN MALTA

A preliminary plant disease survey of Malta has recently been completed covering the period January to June this year. Unfortunately the season was an unusually dry one so that the number and intensity of plant diseases noted may not be typical of most years. Potato blight (Phytophthora infestans), for example, was not common in Malta, although in the more humid valleys of Gozo, the neighbouring island, its development illustrated what a menace this disease could be, given suitable climatic conditions, to the comparatively large acreage of potatoes grown in Malta. Apparently this disease is normally prevalent on the winter crop (November to January), and it is undoubtedly one of the most important on the Island.

Most Maltese farmers are quick at spotting small loci of blight infection within a field: an ability derived by experience. Many farmers, though not all, also appreciate the necessity for protecting their crops by spraying. Usually they mix their own Bordeaux in a large cask (mastella) and apply this using a hand knapsack sprayer. The composition of the mixture for the winter crop is as follows:-

3 rotoli copper sulphate (1 rotolo 1·75 lbs.)
2 rotoli unslaked lime
36 gallons water.

For the spring crop, it is customary to increase the lime content by approximately half a rotolo. Spraying of the winter crop usually starts in November when the plants are about six inches high or showing two pairs of expanded leaves. The number of applications varies. Three sprays applied at approximately 15-day intervals appears to be the common practice but in a very wet season as many as five applications may be made. Spraying of the spring crops is similar, starting about the end of January or beginning of Febraury.

Observations made during the present survey indicate that the spray application is frequently poor. Many farmers succeed in covering the upper surfaces of the leaves with a thick deposit of Bordeaux but leave the lower surfaces with scarcely a trace. Much of the present work of the Department of Agriculture is concerned with teaching farmers to spray efficiently.

Phytophthora infestans on tomatoes was also common in Gozo but not in Malta. Farmers, however, did not appear to appreciate the connection between this and late blight of potatoes so that field sanitation left much to be desired.

Fungal diseases of other vegetable crops which were particularly destructive were rust (Uromyces fabae) on broad bean, downy mildew (Peronospora destructor) on onion, rust (Puccinia allii) on both onion and garlic, and powdery mildew (Oidium sp.) on cucurbits.

Broomrape (Orobanche sp.) was found to be a serious menace to the cultivation of broad beans and, to a certain extent, of peas. It was not uncommon to find a field of broad beans wilting and some plants even uprooted as a result of the vigorous growth of this parasite. Although legislation exists, aimed at controlling this noxious weed, it is enforced with difficulty. Most farmers are convinced that the seed of the broomrape comes with the seed of the broad bean: their association is inevitable. Rogueing out the broomrape is, therefore, a waste of time! Some farmers even clear their fields of broad beans after harvesting and leave a large stand of broomrape flowering.

Fruit trees generally seemed to be more affected by insect pests than fungal or bacterial diseases. However, scab (Venturia pirina) was exceedingly common on the small type of pear known locally as "bambinella" and caused a considerable reduction in the market value of the fruit. It was not observed on other varieties, nor, indeed, was apple scab (V. inaequalis) found on the Island.

Citrus trees in general were much affected by various forms of "die-back", with

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which were associated Colletotrichum gloeosporioides, Diplodia natalensis, and Alternaria citri. Such diseases appeared, however, to result mainly from the extensive age of the trees and poor cultivation. Much replanting is required if this industry is to be placed on an economic footing.

Vines were particularly healthy, the incidence of downy mildew (Plasmopara viticola) and powdery mildew (Uncinula necator) being low. This may have been largely a result of the dry season, although an extensive spraying programme is carried out against these particular diseases.

Amongst the more interesting records, disease material of which was new to the C.M.I. Herbarium, were Peronospora viciae on sweet pea, which was very common in Malta (though not apparently elsewhere), Melampsora pulcherrima on Mercurialis annua, and a Phyllachora sp. on Spanish sanfoin (Hedysarum coronarium) which was also very common but does not appear to have been described previously.

B.E.J. Wheeler

COCONUTS. THE PLANT PATHOLOGIST'S BANE

The various mysterious coconut diseases that occur in different parts of the world answer to names which themselves indicate how little is known of their cause: bronze leaf wilt of the Caribbean (and its West African versions, Cape St. Paul wilt and Awka disease), unknown disease (which a planter who had lost most of his coconut acreage from it remarked was only too well known to him!), now to be called lethal yellows, cadang-cadang, root disease. A recent report from Florida tells of a disease of coconuts and Royal palms, starting with symptoms on the outer leaves, in this case described as 'greying', and as usual ending in a collapse of the whole crown with the finding of the inevitable bacteria in the heart. In the Phillipines the electron microscope has recently been called to assist with cadang-cadang disease, and comparison of the sap of healthy and diseased palms suggests the presence of a virus in the latter. In other parts of the world also a virus cause of these maladies is suspected, but rather from lack of any tangible evidence of a fungal or bacterial pathogen than from any more definite reason. Attempts to associate the West African version of bronze leaf wilt with a soil deficiency by dosing palms with an assortment of trace elements have as yet yielded no results, and the search for a possible parasite from among the many organisms found associated with diseased palms is being renewed.

Once the answer to one of these baffling disease problems is found, the solution of the others will probably become easier, but a slow growing plant such as a coconut does not appeal to the research worker who hopes to get quick results. Only by obtaining a knowledge of 'how the coconut ticks', probably necessitating many years of investigation in accordance with a carefully laid out programme, will it be possible to get the solution to these problems.

E.B.M.

(continued from p. 62)

In experiments with 1 and 2 spraying with copper oxychloride reduced the average infection from 28·0 to 19·3 per cent. But in experiments 3 and 4 in which unsprayed controls were eliminated, copper oxychloride reduced infection to 7·8 per cent. The difference between 19·3 and 7·8 per cent. is highly significant ($P = 0·001$). It represents the failure of copper oxychloride to control the infection from spores or bacteria drifting in from the untreated controls; it represents the degree to which a farmer would have been misled if he had been told that spraying his field fortnightly with copper oxychloride would reduce infection from 28·0 to 19·3 per cent.

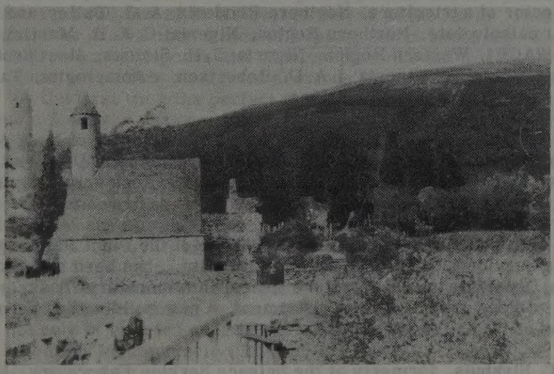
There is a challenge in these results to the designers of field experiments in plant pathology. Making the plots larger and leaving guard rows would reduce the error. But infection gradients are fairly flat from an area-source of spores, and plots would have to be very large to make the error negligible.

J.E. Van der Plank

AUTUMN FORAY OF THE BRITISH MYCOLOGICAL SOCIETY, 1957

The Autumn Foray of the British Mycological Society was held this year in Dublin. About forty mycologists attended the meeting. Those not normally resident in Dublin were accommodated in the Womens' Hostel, Trinity Hall, where a spacious work room was made available. This was provided with books and microscopes lent by the Botany Department of the University. The Department and Library we were also open for use of the members, who arrived on the morning of Friday the 13th September, in time for an afternoon foray. Incidentally, those coming from the British Isles by sea had been the victims of a very unpleasant crossing!

Trips had been arranged so that the foray might cover as wide an area as possible. The state Forest at Woodenbridge and Sheldon, Co. Wicklow, was visited



At Glendalough

on Saturday. The route lay along the coast road with its fine views of bays and cliffs. A stop was made to greet Mrs. Webster, who was spotted pushing a perambulator along the sands. The day was pleasant for collecting and the Society was entertained by the State Forestry School at Sheldon Abbey. A magnificent tea was supplied and although members did their best they were unable to make much impression on a feast scaled to the appetites of young foresters.

Sunday was a free day, but the Society was invited to coffee in the morning by Dr. O'Connor and as most members attended this became a most pleasant social gathering.

The visit on Monday, to Townley Hall, Co. Lough, which belongs to Trinity College, was notable for the rain. The woods are old, with much litter — perfect for fungi, but everything dripped with water. After returning from the foray the evening was spent at a reception held in the Botany Department at University College where Professor and Mrs. Turner and the staff received the Society's members. This was followed by a general meeting of the Society, at which the President presided.

Tuesday morning was free. Many went shopping, but others filled their time with more academic pursuits. A few were fortunate enought to visit the factory of Biotox Ltd., who specialise in the treatment of dry rot and wood worm. Another party visited Guiness's Brewery and after viewing the process were able to sample the product. This party was notably late for lunch and appeared to have thoroughly enjoyed their trip!

The last day was spent at the beautiful lake Glendalough, Co. Wicklow, where those interested were able to see the round tower and seven churches of Glendalough.

The whole foray was most delightful and a great success, enough interesting material being collected, though fungi were not very abundant. Unfortunately, owing to illness, Dr. C. F. Hassell was unable to take part in the foray, but many of the older members found time to visit him.

Our thanks are due to Dr. M. Stuart and Dr. P. O'Connor for all the work entailed in making such a smooth running and enjoyable arrangements for the Society.

A. H. S. Brown

PERSONAL NEWS

Visitors to C.M.I.

Among overseas visitors were Miss J.M. Dingley, New Zealand; Miss E. Harrison, Northern Nigeria; Miss R. McAleer, Western Australia; T.W. Tinsley, Nigeria; J.W. Blencowe, Ghana; M.S. Khan, West Pakistan; A. Omvik, Norway; Z. Maleki, Iran; J. Meyer, Belgium; R.K. Grover and S.N.S. Srivastava, India; J. Rayss, Israel; L.M. Ames, U.S.A.

Appointments, Promotions, Retirements, etc.

The Overseas Service Division of the Colonial Office announce the following appointments: A.B. Killick, Minister of Natural Resources, Uganda; C.E. Johnson, assistant director of agriculture, Northern Rhodesia; A.G. Bailey, and D. MacDonald, plant pathologists, Northern Region, Nigeria; C.K.H. Martini, plant pathologist, WACRI, Western Region, Nigeria; J.H. Simons, plant protection officer, Western Region, Nigeria; I.A.D. Robertson, entomologist, Tanganyika; C.R. Wallace, entomologist, St. Helena.

Professor T. Wallace has retired from the post of director of Long Ashton Research Station with its accompanying honorary chair at Bristol University and his place has been taken by Dr. H.G.H. Kearns, O.B.E., formerly entomologist to the Station.

Dr. M.W. Cormack, formerly officer in charge of the Plant Pathology Section of the Science Service Laboratory, Lethbridge, Alta., has been appointed chief of the Canada Department of Agriculture Research Laboratory, Saskatoon, Sask. To house the various groups of the Department, a new building has been erected on the campus of the University of Saskatchewan.

Dr. John T. Slykhuis, formerly at the Science Service Laboratory, Lethbridge, has been appointed head of the Plant Pathology Unit of the Botany and Plant Pathology Laboratory, Ottawa, Ont. Dr. Slykhuis has only recently returned from a year's leave at Rothamsted. He also spent some time in the British Isles and the Continent observing the virus disease situation in cereals.

C.K. Reheem, B.Sc., AIARI., scientific liaison officer, has been appointed to represent Pakistan on the Executive Council of the Commonwealth Agricultural Bureaux.

Dr. R.H. Stoughton, professor of horticulture at the University of Reading, has been appointed principal of the University College of Ghana.

Dr. R.H. Phillips, deputy director of the Agricultural Division of FAO, has been appointed director of the Division of International Organisation Affairs, Foreign Service, United States Department of Agriculture.

Royal Society

Lord Salisbury and Sir William Slater, secretary of the Agricultural Research Council, have been elected Fellows.

Royal Edinburgh Society

Dr. R.J. Heim, Musée d'Histoire Naturelle, Paris, has been elected a Fellow.

Dr. H.J.R. Dürr, senior entomologist, University of Stellenbosch, has come to the United Kingdom on a Royal Society and Nuffield Foundation Commonwealth Bursary to study aphids at the Natural History Museum and the Commonwealth Institute of Entomology.

OVERSEAS NEWS

NOTES FROM CANADA

Three reports of recent research in Canada are reviewed briefly below.

Septoria Blight of Oats

In recent years the widespread prevalence of the black stem phase of Septoria blight in eastern Ontario, Quebec, and the Maritime Provinces has caused considerable concern. Severe infections of the culms resulted in lodging of the crop and attacks on the panicles caused darkening and blighting of the kernels.

In a study of the etiology of the disease begun in 1956 by Dr. R.V. Clark, periodic collections were made at Ottawa of young plants, mature plants, and of stubble both in the fall and after its overwintering in the field. These collections were examined for the various states of Leptosphaeria avenaria. The presence of macropycnidia and macrospores and of micropycnidia and microspores of Septoria avenae on plants or stubble confirmed previous findings in the Ottawa district. However, for the first time the perfect state, Leptosphaeria avenaria, was found.

Numerous collections of overwintered stubble were made during the spring, For study, portions of straw showing black stem symptoms were placed in moist chambers and the pieces suspended over glass slides to catch any spores that might be deposited. Not until the first week of June did the collections develop mature asci and ascospores. The ascospores so deposited germinated within 24 hours in the moist chambers. These studies bear out the findings of Dorothy E. Shaw (CAN. J. BOT., 35, 97-112, 1957) working with material collected in Eastern Canada and of M. D. Huggman (PHYTOPATHOLOGY, 45, 278-280, 1955) that the ascospores are first formed in early June. The evidence suggests that the ascospores provide ample inoculum to initiate an outbreak of Septoria blight of oats. However, the role of infected seed in spreading the disease as reported by Mary Noble and Isabel G. Montgomerie (TRANS. BRIT. MYCOL. SOC., 39, 449-459, 1956) has not been confirmed.

Cucumber Ringspot

A virus disease with characteristic symptoms of the ringspot group appeared early in April, 1956, in a single crop of greenhouse cucumbers at Kingsville, Ontario. Three isolates differing in virulence were readily obtained by sap transmission, and since then they have been under study by Dr. C.D. McKeen at Harrow. The most virulent isolate causes extensive browning and necrosis of the veinal tissue of the leaves and a rapid necrosis of stem and root tissues of the cucumber plant as soon as the virus becomes systemic. Fruits show a variety of concentric ring patterns, the colour being dark green to light green or grayish brown. Cucumber plants ranging in age from seedlings to mature plants usually die 2 to 4 weeks after they are inoculated. To date the only host other than cucumber in which the virus has become systemic is snapbean. In this host the virus causes a reddish-brown necrosis of the veins, appearing first as a ring or spot on a vein and later radiating along the adjacent small veins. Ordinary strains of the tobacco ringspot virus have not given protection against this cucumber ringspot virus. The disease has not been previously reported in North America. Y.V. Koot and H.J.M. Dorst (TIJDSCHR. PLZIEKT., 61, 163-164, 1955) have recorded a similar disease in cucumbers grown in cold frames in South Holland.

Bull's-Eye Rot of Apples

Experiments were conducted in 1955 by officers of the Experimental Farm, Summerland, B.C., to explore the possibility of extending the storage life of Newtown apples by packing them in polythene bags. Unexpectedly there were indications that the losses from bull's-eye rot caused by Neofabraea perennans might be much greater in this type of pack than in the conventional paper wraps.

In 1956 Newtown apples from orchards in which perennial canker, caused by the same fungus, is present were either wrapped in paper or packed in polythene bags and sealed. As a further check, half the apples of each group were inoculated with

a conidial suspension of the organism before packing. All the boxes were placed in storage at 32°F. in October, 1956. When the apples were examined by Dr. D. L. McIntosh upon their removal from storage in March, 1957, the highest percentage of bull's-eye rot was found in the samples packed in polythene bags. Moreover, the results showed that a high percentage of the fruit from trees affected with perennial canker is carrying latent infections of bull's-eye rot. Also the high storage humidities that prevailed in the polythene bags are believed to be important in the development of the disease in stored apples. How the concentration of oxygen and carbon dioxide in the bags affects disease development is unknown.

I. L. Conners

NEWS FROM NEW SOUTH WALES

Death of Citrus on Trifoliata Stock: Evidence is accumulating that a dry rot condition of citrus trees on trifoliata stock (sometimes referred to by citrus growers as "sudden death") is caused by the common wood-rotting fungus Coprinus micaceus. It has not so far proved possible to isolate the fungus directly from affected tissue but Coprinus mycelium is constantly associated with diseased roots and the fructifications develop quite quickly on them, if buried in soil. The mechanism of infection would appear to be that the fungus becomes established in a length of dead root killed by some other cause and that it kills by toxic action well in advance of invading hyphae. Coprinus micaceus is a relatively common species, coming up abundantly near the base of eucalypt trees, old stumps, posts, telephone poles, and over buried wood, sometimes for somewhile after removal of the wood. More than 100 citrus trees on trifoliata stock are known to have been affected with this form of dry rot over the past several years. The disease is receiving study by Dr. Lilian Fraser.

A Mycosphaerella associated with Septoria depressa: Some years ago Dr. T. B. Kiely made collections of citrus leaves from various parts of western N.S.W. with the object of determining whether the black spot fungus Guignardia citricarpa was present in them in the latent form. The treatment he used in an attempt to develop the perfect stage of Guignardia in these leaves resulted in the appearance of a Mycosphaerella on a collection of lemon leaves from an orchard at Barooga. Single ascospore cultures which he made appeared to be identical with cultures of Septoria depressa from diseased fruit.

In November last year collections of fallen lemon leaves from the same Barooga orchard which had overwintered beneath the trees and from fallen orange leaves from a Leeton orchard were found by Dr. Lilian Fraser to be very heavily covered with the perithecia of a similar Mycosphaerella. Single ascospore cultures have been used in inoculation trials to determine the connection between this fungus and Septoria depressa.

Black Ring Disease of Crucifers: During a recent inspection by Mr. R. J. Conroy of a seed merchant's trial grounds at Dundas in the Sydney Metropolitan Area, crucifer plants were observed showing symptoms similar to those described for black spot ring disease (Tompkins et al. J. AGRIC. RES., 57, 12, 929-943, 1938) caused by a virus of the turnip virus 1 group according to Pound and Walker (J. AGRIC. RES., 71, 6, 255-278, 1945).

The disease was present on broccoli, cabbage, and cauliflower. On one variety of broccoli (Waltham No. 29) severe infection had resulted in extensive blighting of outer and middle leaves, while less severe damage was present on Morse Early and Morse Medium broccoli. A trace infection was also present on Short's cauliflower and Enkhuizen Glory cabbage.

Inoculations to tobacco and N. glutinosa gave reactions described for turnip virus to which black spot ring disease is attributed [in Australasia]. It is considered that this virus has been present in New South Wales for some time but has escaped notice until a highly susceptible variety of broccoli was grown.

C. J. Magee

NEW ZEALAND NOTES

Two Severe Outbreaks of Cauliflower Mosaic Virus on Turnip and Swede Crops: In early autumn, 1956, reports of extensive rotting of soft turnip crops in South and North Canterbury were investigated. The typical symptoms were a bright yellowing of the older leaves of plants, especially near the edge of crops. Within the crop the sequence of symptoms was apparent. Firstly, after the bright yellowing of the oldest leaves the plants showed a veinal and interveinal necrosis often on one half of a leaf. Following these 'shock' symptoms, the leaves became twisted towards the particular side of the plant which was initially infected. The youngest leaves became more twisted and rosetted and eventually the larger ones dropped leaving only a small rosette of twisted mottled leaves. At this stage necrosis of the tap root occurred and was rapidly followed by secondary bacterial attack resulting in total rotting of the bulbs. There was complete devastation by the disease over thousands of acres in Canterbury and if it had not been for a mild autumn and winter enabling continued pasture growth there would have been a serious shortage of winter feed throughout Canterbury.

In the two previous seasons there had been occasional reports of this disease both in North and South Canterbury, but the preliminary diagnosis based on bacterial attack, leaf yellowing, and vascular necrosis, had been black-rot (Xanthomonas campestris), although no pathogenic bacterial could be isolated from the vascular necrosis in turnip bulbs.

In the 1957 season we have suffered the second serious outbreak in succession of what was, in fact, cauliflower mosaic. However, this year the damage, although not quite so serious in Canterbury, has become far more widespread, and is causing extensive losses in the Nelson province at the top of the South Island and throughout Otago where it has also attacked swede turnip crops which are more prevalent in that province. The loss this year would probably be between 20,000 and 50,000 acres of turnips and 10,000 and 20,000 acres of swedes completely destroyed.

These two serious epidemics of cauliflower mosaic appear to have been the result of favourable seasons for the carry over of infection on resistant brassica seed crops such as marrow stem kale, thousand headed kale, and rape, and then after the flowering of these crops in September the migration of the infected aphids (Brevicoryne brassicae and Myzus persicae) to young crops of rape sown in October. The rape crop in Canterbury is notorious for the severity of aphid infection and with the wilting and ripening of the severely infected crop in January and February the mass flights of winged aphids then occurred and spread the cauliflower mosaic infection in the December and January sown swede and turnip crops, throughout Canterbury in 1956 and also throughout Otago in 1957.

The key to these epidemics appears to be the build-up of infection on the rape crops grown for lamb fattening throughout Canterbury. The Plant Breeders at Crop Research, Lincoln, have been breeding for aphid resistance for several years and now have selections which are both resistant to aphids and also to cauliflower mosaic. When these selections are released and grown widely throughout Canterbury and Otago it is anticipated that the build-up of cauliflower mosaic and the huge increase in aphid populations on the rape crops will be eliminated or greatly reduced with a consequent return to more normal growing conditions and relatively healthy turnip crops.

In the meantime a search for resistant varieties of turnips has revealed that there are several more susceptible than the present commercial varieties but none with a sufficient degree of resistance to be able to survive under epidemic conditions. With swede varieties, however, we have the interesting situation that all those resistant to turnip mosaic are also resistant to cauliflower mosaic. Four varieties at present widely grown for their aphid resistance, Wilhelmsburger, Sensation, Calder, and Wye (also club-root resistant) have been found to be highly resistant, although under extremely severe attacks up to 50 per cent. of these varieties may become infected.

The resistance in the Calder variety which was bred at the Crop Research Division, Lincoln, was derived from Sensation. Calder has in turn been used as the source of resistance in the development of aphid- (and cauliflower mosaic-) resistant rape. Although these outbreaks of cauliflower mosaic have caused serious losses in the two major turnip and swede growing areas in New Zealand the future

position would appear to be more promising in view of the work of Plant Breeders in developing resistant varieties.

Science on Display. Open Week at Mt. Albert: On 25th February the Hon. R. M. Algie, minister in charge of DSIR opened an exhibition of Scientific activities at the Mt. Albert Research Station. The minister took the opportunity of explaining the value of results achieved by the two Divisions of his Research Department that are stationed at Mt. Albert, i. e. the Plant Diseases Division and Fruit Research Station. In conclusion he was able to announce that the Rockefeller Foundation of New York had given generous recognition to the work of these Divisions by making a grant of 10, 000 dollars to assist biochemical and physiological research that is in progress.

From Monday until Saturday of that week the Laboratory was open to all members of the public, and some 6, 000 people were able to see for themselves how scientists work. Among these were organised parties from all the secondary schools in the Auckland area. It was obvious that laboratories and glasshouses are not designed to facilitate movement of visitors in mass, but the problem was overcome to some extent by marking out a route with sign posts and a system of arrows on the floor. There were 36 stations containing exhibits, and at each station one aspect of current research was on show. Methods or presentation varied but in most there was a brief written outline of the problem, well labelled specimens, equipment used for the particular work, and an explanation of control measures. Every exhibit was made self explanatory with labels and legend but to answer awkward questions an officer familiar with the work was on duty at each station. Questions were many and varied. A booklet giving a list of the stations and other relevant information was available to each visitor.

The 36 stations included the following displays. Control of plant diseases by antibiotics, taxonomy of fungi, fungous diseases of field crops, bacterial diseases of plants, identification of fungous diseases, moulds in industry, plant virus diseases, sterilization of soil, inoculation of lucerne and clovers with nodule organisms, chemical control of diseases and pests, death of pines, tomato leaf mould, virus diseases of fruit trees, plant quarantine, timber preservation, biochemical investigations on plants and insects, and field trials for control of plant diseases.

Each station achieved a high standard of presentation, and a serious attempt had been made to explain everything in common language. This feature was particularly appreciated by visitors, and on every hand there were complimentary remarks. The whole venture was so clearly a success that we can reasonably expect to see it repeated in the not-distant future.

Research upon Mycorrhizas at Otago University: A paper by T. M. Morrison shortly to be published in the NEW PHYTOLOGIST reports upon a series of pot experiments designed to elucidate the host-endophyte relationship in Pernettya macrostigma (Ericaceae), and concludes that it is for the most part comparable with that in Pinus. A similar investigation of Griselinia littoralis, which normally has a heavy Rhizophagus infection, is still in progress.

At the second annual meeting of the New Zealand Microbiological Society at Massey College, Palmerston North, on 15th and 16th May, 1957, the programme included a paper by Dr. E. E. Chamberlain on 'a fungal root and stem canker of pines', one by Mr. R. Close on 'a species of Gibellula on a pupa of Emperor Moth', 'some observations on spore formation in the genus Streptomyces' by Dr. T. R. Vernon, and a discussion of 'unknown factors in soil disinfection' by Dr. H. Jacks.

H. C. Smith

NEWS FROM INDIA

Uromyces indigoferae Diet. & Holway: Rust on different species of Indigofera commonly occurring in India has been studied in detail at the I. A. R. I. and shown to be due to U. indigoferae. Examination of type specimens of both U. indigoferae and U. orientalis Syd. revealed that the two are identical: the mode of germination of uredo- and teleutospores and their temperature requirements were found to be similar. As the sporidia from the germinating teleutospores did not infect any of

the Indigofera species, it appears this rust is heteroecious. Since the rusts on I. linifolia and I. tinctoria were found to be specific for their respective hosts, the presence of physiologic forms in this organism is indicated.

Chirke Disease of Cardamom: A new disease of larger cardamom (Amomum subulatum), which is characterized by the production of mosaic mottling symptoms on the leaves of affected plants, has been observed at the Kalimpong substation of the I.A.R.I., Darjeeling district (West Bengal). The disease, which is sap-transmissible, is quite distinct from Foorkey disease of larger cardamom present in the same area, which causes stunting and excessive tillering.

Soyabean Mosaic: A mosaic disease of soyabean (Glycine max) which was found to be very serious at Delhi is characterized by a typical mosaic pattern of irregular light and dark green areas accompanied by blistering and malformation of the leaf lamina. The disease is sap-transmissible and carried through seed. Four species of aphids viz. Aphis gossypii, Myzus persicae, and two others, which have been tentatively identified as A. craccivora and Lipaphis erysimi, have been found to be vectors. The causal virus has been identified as Soja virus I [Soybean mosaic virus].

NOTES FROM AFRICA

NIGERIA

A New Virus Affecting Maize: In May 1955, several South American varieties of maize grown at Ibadan showed leaf spotting which at that time was thought to be a heritable chlorophyll deficiency common in the American maize-growing areas. The symptoms were again observed in 1956 and it was noticed that introduced varieties from Central and Southern America only were affected and not local varieties. In the first-season crop this year the incidence of spotting was greatly increased, and in one trial plot 64 Mexican, Caribbean, and Costa Rican varieties were badly attacked. For the first time severe spotting appeared on five per cent. of local maize varieties and to a lesser degree on 28 out of 90 West African varieties incorporated in the same trial.

The first indication of the disease is the appearance of small, circular, translucent spots near the tips of the older leaves. These spots, approxiamtely 2 to 3 mm. in diameter, are confined to the intervascular areas and are never confluent. The spots gradually progress towards the base of the leaf and in some very susceptible varieties the intensity of spotting was seen to be as high as 22 per sq. cm. Translucent spots typical of early attack are shown in fig. 1.

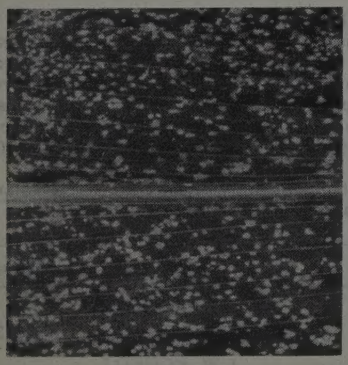


Fig. 1 (left). Portion of maize leaf showing the translucent spots characteristic of early attack. Fig. 2 (right). The general 'marbled' appearance at a later stage of infection.

Fig. 3. Infected leaf showing die-back of tip and margins 7-10 days after first appearance of symptoms.

In the most susceptible varieties the spots become necrotic and surrounded by concentric, pellucid rings which spread rapidly, giving the entire leaf the marbled appearance shown in fig. 2. Within a short time the tip and margin of the affected leaf show burning and die-back with death of the leaf within ten days from initial infection. A typical infected leaf from a susceptible variety of maize is shown in fig. 3.

The initial and final symptoms of this disease are very similar to those of virus leaf fleck of maize described by Stoner in California (PHYTOPATHOLOGY, 42, pp. 683-689), but he does not record the marbled appearance which has been observed at Ibadan. The severe outbreak of the disease this year coincided with an unusually high incidence of the maize leaf aphid, Rhopalosiphum maidis, which Stoner proved to be one of the vectors of the leaf fleck virus. If the virus continues at its present epiphytotic level it must be considered a major maize pathogen.

Maize Research Unit, Ibadan. R.H. Cammack

SOUTH AFRICA

The following note by Dr. R.A. Christ, Division of Plant Pathology, Department of Agriculture, Pretoria, raises a point of considerable interest in the layout of spraying trials.

Control Plots in Experiments with Fungicides

What is the value of untreated control plots in an experiment in which plants are sprayed or dusted with fungicides? If the purpose of the experiment is to show a qualitative effect of treatment, there is no objection. But if the purpose is the quantitative evaluation of the fungicide, untreated plots serve not only as controls but also as sources of infection. This can cause the value of the fungicide to be underestimated, because a farmer using the fungicide would leave no unsprayed danger-spots.

Experiments at the Pretoria Horticultural Research Station brought out this point. Four separate experiments with tomatoes (var. Pearson) were laid out each about $\frac{1}{4}$ to $\frac{1}{2}$ a mile apart from each other. The plots were 3 rows of 10 plants each, and there were 4 replicates for each treatment. In the first two experiments every second plot was sprayed fortnightly with copper oxychloride, the remaining plots being left untreated as a control. In the other two experiments every second plot was sprayed with copper oxychloride, the remaining plots however, were not left untreated but were sprayed fortnightly with Bordeaux mixture.

The percentages (by count) of fruits infected with early blight (Alternaria solani) and bacterial spot (Xanthomonas vesicatoria) are given in table 1.

Experiment No.	Control	Average	Copper oxychloride	Average
1	25·2		17·8	
2	30·8	28·0	20·8	19·3
	Bordeaux			
3	3·5		4·9	
4	8·9	6·2	10·7	7·8

(continued on p. 54)

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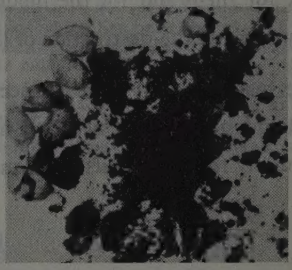

Bunted wheat. Black spore masses clearly visible within the grain.

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